

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C. 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 12 September 2000 (12.09.00)	
International application No. PCT/US99/00653	Applicant's or agent's file reference
International filing date (day/month/year) 12 January 1999 (12.01.99)	Priority date (day/month/year)
Applicant BURG, Gary, Robert et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

01 August 2000 (01.08.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer R. Forax Telephone No.: (41-22) 338.83.38
---	--

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference DN1999001	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US99/00653	International filing date (day/month/year) 12/01/1999	Priority date (day/month/year) [12/01/1999] ^A
International Patent Classification (IPC) or national classification and IPC B29C47/64		
Applicant THE GOODYEAR TIRE & RUBBER COMPANY et al.		

AIE

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.



- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

CORRECTED
VERSION

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 01/08/2000	Date of completion of this report 19.02.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Philpott, G Telephone No. +49 89 2399 8620 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US99/00653

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-3	as originally filed	
1a,4	with telefax of	29/11/2000

Claims, No.:

1-11	with telefax of	29/11/2000
------	-----------------	------------

Drawings, sheets:

1/3-3/3	as originally filed
---------	---------------------

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US99/00653

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-11
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US99/00653

1. The various definitions of the device given in independent claims 1,3,7 and 9 make it uncertain as to what aspects of the claimed invention constitute essential features. These claims hence render each other unclear, with the result that the conditions of Art. 6 PCT are not met. Any newly drafted independent claim should rectify this, also ensuring that the claims are drafted with the minimum necessary number of claims **in any one category** (Rule 6.1(a)(b) PCT and with dependent claims as appropriate (Rule 6.4 PCT). It is noted that Art. 6 PCT deals with the clarity of the claims, not, as the applicant implies in his reply to the written opinion, with unity of invention (Rule 13 PCT).
2. There is no basis in the claims as searched for the combination of features of claim 3. In particular, the feature "a downstream portion of decreasing diameter in said direction of flow providing a generally conical surface generally parallel to a converging tapered wall of an adjacent flow channel" was not present in either of originally filed claims 1 or 3 (as asserted by the applicant in his reply to the written opinion). Nor can it be expected that a combination of the **apparatus** features of claims 1 and 3 has been searched with the feature quoted above, when aspects of the said feature only appear in **method** claims (e.g. claims 8 and 10). In this instance an opinion is given on claim 3, nevertheless, for the purposes of any future regional prosecution of the present application, attention is drawn to the fact that claims containing unsearched features are not normally examined (R. 66.1(e) PCT).
3. GB-A-1 007 140 (D1) with particular reference to the figures, describes an extruder having a screw (12) with a helical flight rotatable in a cylindrical barrel for propelling an extrudate material from an upstream portion to a downstream portion of said barrel and an extruder screw nose at a discharge end of said extruder, whereby the screw nose has an upstream portion of said barrel to a downstream portion, and in which said screw nose has an upstream portion (e.g. 14, 24, 34) of increasing diameter in the direction of flow of said extrudate providing a generally conical surface (see page 7, line 13) for decreasing a transition space between said screw nose and said cylindrical barrel and maintaining working engagement with said extrudate to maintain pressure on said extrudate at said discharge end.

4. WO-A-85 01467 (D2), with particular reference to fig. 4, describes an extruder screw nose for a discharge end of an extruder having a screw (63) with a helical flight rotatable in a cylinder barrel (64) for propelling an extrudate material from an upstream portion of said barrel to a downstream portion, and in which said screw nose has an upstream portion (67) of increasing diameter in the direction of flow of said extrudate providing a generally conical surface (see page 7, line 13) **potentially capable of** decreasing a transition space between said screw nose and said barrel and maintaining working engagement with said extrudate to maintain pressure on said extrudate at said discharge end. However, it is noted that the diameter of the barrel section in Fig. 4 is also increased, which would not lead to compression of the extrudate so as to maintain pressure on it at the discharge end.
5. The only feature of claim 1 not taught by D1 is the aspect of two helical flights on the extruder screw. However, as accepted by the applicant, such a feature is extremely well known in the field. As examples both EP-A-490 058 (D3) and GB-A-1 242 481 (D4) are cited. Claim 1 therefore fails to meet the requirements of Art. 33(3) PCT. It is noted that arguments relating to the space between the end of the screw flight and the screw nose are not relevant to this analysis, as a feature defining this space is not explicitly present in claim 1. Moreover, once steady state has been achieved in D1, the effect of a small area of any enlarged space prior to the smear head will be negated by the back pressure resulting from the decreasing transition space. It is also observed that the basis for this analysis is D1, thus the problem to be overcome is one of inadequacy of the extruder screw of D1, for which the skilled man has adopted the solution of two helical flights. Whilst it is possible to attempt an analysis starting from the extruder of D3 or D4, and derive a problem associated with porosity due to the expansion of volatiles under reduced pressure, this is not the basis used for the present assessment, and therefore has no bearing on it.
6. The features of claim 2 are also taught by D1 and D2 by virtue of the conical portion in front of area (16, 26, 36) in D1, and portion (105) in fig. 4 of D2. Claim 2 thus also fails to meet the requirements of Art. 33(3) PCT.
7. Claims 3-6 deal with specific angles of the cone shape of the extruder nose. The

skilled man, once in possession of the knowledge of claim 1, would clearly conduct experimental tests to deduce the optimal arrangements for the nose cone angles. As such the features of claims 3-6 are merely design options which the skilled man could easily arrive at, rather than inventive (Art. 33(3) PCT) developments.

8. Compression of the extrudate prior to e.g. increase pressure injection, is a common feature of an extrudate, and is often achieved by incorporation of a "smear head", such as that known from D1. Given that the conical arrangement of claim 1 is already known per se, and the use of such an extruder nose shape in conjunction with an appropriate barrel profile to produce a pressure increase is also known, claims 7-11 are not considered inventive (Art. 33(3) PCT). The arguments of paragraph 5 above concerning the enlarged area in D1 between the end of the screw flight and the screw nose apply equally in respect of claims 7-11.
9. D2 and D3 are not incorporated into the description ((Rule 5.1(a)(ii) PCT). For the applicant's future reference, it is noted that the use of the expression D1-D4 in the written opinion meant D1 to D4, not D1 and D4.
10. The two-part claim style is not used (Rule 6.3 PCT) correctly, as D1 teaches many of the features presently in the characterizing portion of the independent claims.

1A

Examples of extruders having screws with two helical flights are shown in Great Britain patents GBA-1007140 and GB 1 242 481.

maintains the pressure on the rubber and prevents expansion of the volatiles in the rubber. After passing over the conical surface 42 of the upstream portion 36 of the screw nose 26, the rubber flows over the downstream portion 38 which has a decreasing diameter in the direction of flow with a surface 42 at the angle Y , in substantially parallel relation to the tapered surface 44 of the flow channel head 14 which is inclined at an angle Z relative to the axis 0-0 of the screw nose. With this configuration the rubber is confined to the space between the tapered surface 44 and the conical surface 42 and maintained in working engagement with these surfaces 44 and 42 of the tapered wall and upstream surface, thereby maintaining pressure on the rubber and preventing the formation of bubbles by expansion of the volatiles in the rubber material. The rubber material then flows through the flow channel 16 of the flow head 14 which has a generally constant sectional area to a die (not shown) where it is formed in the final shape without expansion of the volatiles, providing a bubble free, smooth surfaced extrudate.

CLAIMS

1. An extruder 12 having a screw 18 with at least two helical flights 30, 32 rotatable in a cylindrical barrel 20 for propelling an extrudate material from an upstream portion 36 to a downstream portion 38 and an extruder screw nose 26 at a discharge end 28 of said extruder of said barrel characterized by said screw nose 26 having an upstream portion 36 of increasing diameter in the direction of flow of said extrudate providing a generally conical surface 42 for decreasing a transition space 46 between said screw nose 26 and said cylindrical barrel 20 and maintaining working engagement with said extrudate to maintain pressure on said extrudate at said discharge end 28.
2. The extruder according to claim 1 further characterized by said screw nose 26 having a downstream portion 38 of decreasing diameter in said direction of flow providing a generally conical surface 42 generally parallel to a converging tapered wall 44 of an adjacent flow channel block 16 for maintaining working engagement with the extrudate and maintaining the pressure on the extrudate at said discharge end 28.
3. The extruder screw nose 26 for a discharge end 28 of an extruder 12 having a screw 18 with at least two helical flights 30, 32 rotatable in a cylindrical barrel 20 for propelling an extrudate material from an upstream portion 36 of said barrel 20 to a downstream portion 38 of said barrel 20 characterized by said screw nose 26 having an upstream portion 36 of increasing diameter in the direction of the flow of said extrudate providing a generally conical surface 40 disposed at an angle of 45 degrees to 65 degrees relative to the axis of the screw nose 26 and a downstream portion 38 of decreasing diameter in said direction of flow providing a generally conical surface 40 generally parallel to a converging tapered wall 44 of an adjacent flow channel block 14.
4. The extruder screw nose 26 of claim 3 further characterized by said angle of said conical surface 40 of said upstream portion 36 being about 50 degrees.
5. The extruder screw nose 26 according to claim 3 further characterized by said generally conical surface 40 of said downstream portion 36 being at an angle of 35 degrees to 45 degrees relative to the axis 0-0 of said screw nose 26.
6. The extruder screw nose 26 of claim 5 further characterized by said angle of said generally conical surface 40 of said downstream portion 36 being at an angle of about 40 degrees.
7. A method of extruding a shaped visco-elastic component, comprising:

- (a) feeding a visco-elastic material into a cylindrical extruder barrel 20 at a feed end 22 of said extruder 12,
 - (b) rotating a screw 18 to mix and provide working engagement of said screw 18 with said cylindrical extruder barrel 20 characterized by,
 - (c) maintaining working engagement of said screw 18 and said extruder barrel 20 at a discharge end 28 of said extruder 12 by confining the flow of said visco-elastic material through a transition space 46 between a screw nose 26 on said screw 18 and said cylindrical extruder barrel 20 wherein said screw nose 26 has an upstream portion 36 of increasing diameter in the direction of flow of said material providing an upstream generally conical surface 40.
8. The method of claim 7 further comprising maintaining working engagement of said visco-elastic material from said upstream portion 36 to a downstream portion 38 of decreasing diameter in said transition space 46 wherein a flow channel head 14 with a tapered wall 44 is attached to said extruder 12 characterized by conveying said visco-elastic material in working engagement with said downstream portion 38 of said screw nose 26 and said tapered wall 44 of said flow channel head 14.
9. An extruder 12 and flow channel head assembly 10 comprising an extruder 12 having a screw 18 and cylindrical barrel 20 with a screw flight 30 extending from a feed end 22 to a discharge end 28, said discharge end 28 being attached to a flow channel head 14 containing a flow channel 16 for carrying rubber from said extruder 12 to a suitable die, a screw nose 26 on said extruder screw 18 positioned at the end of said screw flight transition space 46 at said discharge end 28 of said barrel 20 characterized by said screw nose 26 having a radially expanding upstream portion 36 providing a conical surface 40 of increasing diameter in the direction of flow of said rubber for maintaining said rubber in working engagement with said screw nose 26 and said cylinder wall, whereby the pressure on said rubber is maintained in said transition space 46.
10. An extruder 12 and flow head assembly 10 according to claim 9, further characterized by said screw nose 26 having a downstream portion 38 with a conical surface 40 of decreasing diameter in the direction of flow of said rubber spaced from an opposing tapered wall 44 of said flow channel head 14 to maintain working engagement of said rubber with said conical surface 40 of said screw nose 26 and said tapered wall 44 of said flow channel head 14 whereby pressure on said rubber is maintained to prevent expansion of volatiles in said rubber.

11. An extruder 12 and flow head assembly 10 according to claim 10, further characterized by said flow channel 16 having a generally constant cross sectional area from said tapered wall 44 of said flow channel head 14 to a discharge end 28 of said flow channel head 14 to maintain pressure on said rubber and provide time for volatiles in said rubber to be dissolved before ejection from said flow channel head 14.

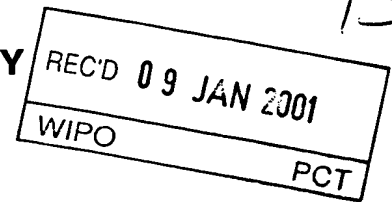
H:\djohnston\FKL FILES\00118d\001127.fcl.FKL2099.claims.doc

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference DN1999001	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US99/00653	International filing date (day/month/year) 12/01/1999	Priority date (day/month/year) 12/01/1999
International Patent Classification (IPC) or national classification and IPC B29C47/64		
Applicant THE GOODYEAR TIRE & RUBBER COMPANY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 6 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 01/08/2000	Date of completion of this report 05.01.01
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 eprmu d Fax: +49 89 2399 - 4465	Authorized officer Philpott, G Telephone No. +49 89 2399 8620 

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US99/00653

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).):*

Description, pages:

1-3	as originally filed	
1a,4	with telefax of	28/11/2000

Claims, No.:

1-6,7 (part)	as amended under Article 19	
7 (part),8-11	with telefax of	28/11/2000

Drawings, sheets:

1/3-3/3	as originally filed
---------	---------------------

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US99/00653

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-11
Industrial applicability (IA)	Yes:	Claims	1-11
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US99/00653

1. The various definitions of the device given in independent claims 1,3,7 and 9 make it uncertain as to what aspects of the claimed invention constitute essential features. These claims hence render each other unclear, with the result that the conditions of Art. 6 PCT are not met. Any newly drafted independent claim should rectify this, also ensuring that the claims are drafted with the minimum necessary number of claims **in any one category** (Rule 6.1(a)(b) PCT) and with dependent claims as appropriate (Rule 6.4 PCT). It is noted that Art. 6 PCT deals with the clarity of the claims, not, as the applicant implies in his reply to the written opinion, with unity of invention (Rule 13 PCT).
2. There is no basis in the claims as searched for the combination of features of claim 3. In particular, the feature "a downstream portion of decreasing diameter in said direction of flow providing a generally conical surface generally parallel to a converging tapered wall of an adjacent flow channel" was not present in either of originally filed claims 1 or 3 (as asserted by the applicant in his reply to the written opinion). Nor can it be expected that a combination of the **apparatus** features of claims 1 and 3 has been searched with the feature quoted above, when aspects of the said feature only appear in **method** claims (e.g. claims 8 and 10). In this instance an opinion is given on claim 3, nevertheless, for the purposes of any future regional prosecution of the present application, attention is drawn to the fact that claims containing unsearched features are not normally examined (R. 66.1(e) PCT).
3. GB-A-1 007 140 (D1) with particular reference to the figures, describes an extruder having a screw (12) with a helical flight rotatable in a cylindrical barrel for propelling an extrudate material from an upstream portion to a downstream portion of said barrel and an extruder screw nose at a discharge end of said extruder, whereby the screw nose has an upstream portion of said barrel to a downstream portion, and in which said screw nose has an upstream portion (e.g. 14, 24, 34) of increasing diameter in the direction of flow of said extrudate providing a generally conical surface (see page 7, line 13) for decreasing a transition space between said screw nose and said cylindrical barrel and maintaining working engagement with said extrudate to maintain pressure on said extrudate at said discharge end.

4. WO-A-85 01467 (D2), with particular reference to fig. 4, describes an extruder screw nose for a discharge end of an extruder having a screw (63) with a helical flight rotatable in a cylinder barrel (64) for propelling an extrudate material from an upstream portion of said barrel to a downstream portion, and in which said screw nose has an upstream portion (67) of increasing diameter in the direction of flow of said extrudate providing a generally conical surface (see page 7, line 13) **potentially capable of** decreasing a transition space between said screw nose and said barrel and maintaining working engagement with said extrudate to maintain pressure on said extrudate at said discharge end. However, it is noted that the diameter of the barrel section in Fig. 4 is also increased, which would not lead to compression of the extrudate so as to maintain pressure on it at the discharge end.
5. The only feature of claim 1 not taught by D1 is the aspect of two helical flights on the extruder screw. However, as accepted by the applicant, such a feature is extremely well known in the field. As examples both EP-A-490 058 (D3) and GB-A-1 242 481 (D4) are cited. Claim 1 therefore fails to meet the requirements of Art. 33(3) PCT. It is noted that arguments relating to the space between the end of the screw flight and the screw nose are not relevant to this analysis, as a feature defining this space is not explicitly present in claim 1. Moreover, once steady state has been achieved in D1, the effect of a small area of any enlarged space prior to the smear head will be negated by the back pressure resulting from the decreasing transition space. It is also observed that the basis for this analysis is D1, thus the problem to be overcome is one of inadequacy of the extruder screw of D1, for which the skilled man has adopted the solution of two helical flights. Whilst it is possible to attempt an analysis starting from the extruder of D3 or D4, and derive a problem associated with porosity due to the expansion of volatiles under reduced pressure, this is not the basis used for the present assessment, and therefore has no bearing on it.
6. The features of claim 2 are also taught by D1 and D2 by virtue of the conical portion in front of area (16, 26, 36) in D1, and portion (105) in fig. 4 of D2. Claim 2 thus also fails to meet the requirements of Art. 33(3) PCT.
7. Claims 3-6 deal with specific angles of the cone shape of the extruder nose. The

skilled man, once in possession of the knowledge of claim 1, would clearly conduct experimental tests to deduce the optimal arrangements for the nose cone angles. As such the features of claims 3-6 are merely design options which the skilled man could easily arrive at, rather than inventive (Art. 33(3) PCT) developments.

8. Compression of the extrudate prior to e.g. increase pressure injection, is a common feature of an extrudate, and is often achieved by incorporation of a "smear head", such as that known from D1. Given that the conical arrangement of claim 1 is already known per se, and the use of such an extruder nose shape in conjunction with an appropriate barrel profile to produce a pressure increase is also known, claims 7-11 are not considered inventive (Art. 33(3) PCT). The arguments of paragraph 5 above concerning the enlarged area in D1 between the end of the screw flight and the screw nose apply equally in respect of claims 7-11.
9. D2 and D3 are not incorporated into the description ((Rule 5.1(a)(ii) PCT). For the applicant's future reference, it is noted that the use of the expression D1-D4 in the written opinion meant D1 to D4, not D1 and D4.
10. The two-part claim style is not used (Rule 6.3 PCT) correctly, as D1 teaches many of the features presently in the characterizing portion of the independent claims.
11. Technical features in claims 1-7 are not followed by reference signs to the drawings (Rule 6.2(b) PCT). It is noted that reference signs are of greatest benefit for the understanding of **apparatus claims**.
12. Newly submitted page 6 does not coincide with the content of the claims on page 6 as submitted on 01.08.00. The applicant is requested to clarify this aspect of the application in any future regional prosecution.

US 009900653

AMENDED SHEET

28-11-2000

4

maintains the pressure on the rubber and prevents expansion of the volatiles in the rubber. After passing over the conical surface 42 of the upstream portion 36 of the screw nose 26, the rubber flows over the downstream portion 38 which has a decreasing diameter in the direction of flow with a surface 42 at the angle Y, in substantially parallel relation to the tapered surface 44 of the flow channel head 14 which is inclined at an angle Z relative to the axis 0-0 of the screw nose. With this configuration the rubber is confined to the space between the tapered surface 44 and the conical surface 42 and maintained in working engagement with these surfaces 44 and 42 of the tapered wall and upstream surface, thereby maintaining pressure on the rubber and preventing the formation of bubbles by expansion of the volatiles in the rubber material. The rubber material then flows through the flow channel 16 of the flow head 14 which has a generally constant sectional area to a die (not shown) where it is formed in the final shape without expansion of the volatiles, providing a bubble free, smooth surfaced extrudate.

CLAIMS

1. An extruder having a screw with at least two helical flights rotatable in a cylindrical barrel for propelling an extrudate material from an upstream portion and an extruder screw nose at a discharge end of said extruder of said barrel to a downstream portion characterized by said screw nose having an upstream portion of increasing diameter in the direction of flow of said extrudate providing a generally conical surface for decreasing a transition space between said screw nose and said cylindrical barrel and maintaining working engagement with said extrudate to maintain pressure on said extrudate at said discharge end.

2. The extruder according to claim 1 further characterized by said screw nose having a downstream portion of decreasing diameter in said direction of flow providing a generally conical surface generally parallel to a converging tapered wall of an adjacent flow channel block for maintaining working engagement with the extrudate and maintaining the pressure on the extrudate at said discharge end.

3. An extruder screw nose for a discharge end of an extruder having a screw with at least two helical flights rotatable in a cylindrical barrel for propelling an extrudate material from an upstream portion of said barrel to a downstream portion of said barrel characterized by said screw nose having an upstream portion of increasing diameter in the direction of the flow of said extrudate providing a generally conical surface disposed at an angle of 45 degrees to 65 degrees relative to the axis of the screw nose and a downstream portion of decreasing diameter in said direction of flow providing a generally conical surface generally parallel to a converging tapered wall of an adjacent flow channel block.

4. The extruder screw nose of claim 3 further characterized by said angle of said conical surface of said upstream portion being about 50 degrees.

5. The extruder screw nose according to claim 3 further characterized by said generally conical surface of said downstream portion being at an angle of 35 degrees to 45 degrees relative to the axis of said screw nose.

6. The extruder screw nose of claim 5 further characterized by said angle of said generally conical surface of said downstream portion being at an angle of about 40 degrees.

7. A method of extruding a shaped visco-elastic component, comprising:

- (a) feeding a visco-elastic material into a cylindrical extruder barrel at a feed end of said extruder,
- (b) rotating a screw to mix and provide working engagement of said screw with said cylindrical extruder barrel characterized by,

- (a) feeding a visco-elastic material into a cylindrical extruder barrel 20 at a feed end 22 of said extruder 12,
- (b) rotating a screw 18 to mix and provide working engagement of said screw 18 with said cylindrical extruder barrel 20 characterized by,
- (c) maintaining working engagement of said screw 18 and said extruder barrel 20 at a discharge end 28 of said extruder 12 by confining the flow of said visco-elastic material through a transition space 46 between a screw nose 26 on said screw 18 and said cylindrical extruder barrel 20 wherein said screw nose 26 has an upstream portion 36 of increasing diameter in the direction of flow of said material providing an upstream generally conical surface 40.

8. The method of claim 7 further comprising maintaining working engagement of said visco-elastic material from said upstream portion 36 to a downstream portion 38 of decreasing diameter in said transition space 46 wherein a flow channel head 14 with a tapered wall 44 is attached to said extruder 12 characterized by conveying said visco-elastic material in working engagement with said downstream portion 38 of said screw nose 26 and said tapered wall 44 of said flow channel head 14.

9. An extruder 12 and flow channel head assembly 10 comprising an extruder 12 having a screw 18 and cylindrical barrel 20 with a screw flight 30 extending from a feed end 22 to a discharge end 28, said discharge end 28 being attached to a flow channel head 14 containing a flow channel 16 for carrying rubber from said extruder 12 to a suitable die, a screw nose 26 on said extruder screw 18 positioned at the end of said screw flight transition space 46 at said discharge end 28 of said barrel 20 characterized by said screw nose 26 having a radially expanding upstream portion 36 providing a conical surface 46 of increasing diameter in the direction of flow of said rubber for maintaining said rubber in working engagement with said screw nose 26 and said cylinder wall, whereby the pressure on said rubber is maintained in said transition space 46.

10. An extruder 12 and flow head assembly 10 according to claim 9, further characterized by said screw nose 26 having a downstream portion 38 with a conical surface 40 of decreasing diameter in the direction of flow of said rubber spaced from an opposing tapered wall 44 of said flow channel head 14 to maintain working engagement of said rubber with said conical surface 40 of said screw nose 26 and said tapered wall 44 of said flow channel head 14 whereby pressure on said rubber is maintained to prevent expansion of volatiles in said rubber.

11. An extruder 12 and flow head assembly 10 according to claim 10, further characterized by said flow channel 16 having a generally constant cross sectional area from said tapered wall 44 of said flow channel head 14 to a discharge end 28 of said flow channel head 14 to maintain pressure on said rubber and provide time for volatiles in said rubber to be dissolved before ejection from said flow channel head 14.

H:\djohnson\FKL FILES\0011\21\001127.01.FKL2089.claims.doc

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/US 99/ 00653	International filing date (day/month/year) 12/01/1999	(Earliest) Priority Date (day/month/year)
Applicant THE GOODYEAR TIRE & RUBBER COMPANY et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.
☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established by this Authority to read as follows:

EXTRUDER SCREW TIP AND ASSOCIATED FLOW CHANNEL

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1
☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

P US 99/00653

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B29C47/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 1 007 140 A (FRASER AND GLASS) 9 October 1962 (1962-10-09) page 1, line 22 - page 2, line 20 figures 1-4	1,2,7-11
Y	EP 0 490 058 A (BERSTORFF GMBH MASCH HERMANN) 17 June 1992 (1992-06-17) column 1, line 1 - column 3, line 11 column 1	1,2,7-11
A	WO 85 01467 A (USM CORP) 11 April 1985 (1985-04-11) page 7, line 9 - page 8, line 3 figure 4	1,2,7-11
	--- -/--	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

17 September 1999

Date of mailing of the international search report

27/09/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Philpott, G

INTERNATIONAL SEARCH REPORT

International Application No

P US 99/00653

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 161 (M-151), 24 August 1982 (1982-08-24) & JP 57 075838 A (MODERN MACH KK), 12 May 1982 (1982-05-12) abstract ---	1,2,5, 7-11
A	US 5 439 633 A (DURINA MICHAEL F ET AL) 8 August 1995 (1995-08-08) abstract figures 2,3 ---	1,7,9
A	GB 1 242 481 A (INTERCOLE) 11 August 1971 (1971-08-11) the whole document -----	1

INTERNATIONAL SEARCH REPORT

Info n on patent family members

International Application No

P US 99/00653

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 1007140	A		NONE	
EP 0490058	A	17-06-1992	DE 4039942 C	30-01-1992
			AT 107572 T	15-07-1994
			AT 108364 T	15-07-1994
			AT 108365 T	15-07-1994
			CA 2057603 A,C	15-06-1992
			CN 1062316 A,B	01-07-1992
			CN 1062492 A,B	08-07-1992
			CS 9103789 A	17-06-1992
			DE 4114541 A	05-11-1992
			DE 4114609 A	05-11-1992
			DE 4114610 A	05-11-1992
			DE 4120016 C	02-07-1992
			DE 4137969 C	15-10-1992
			DE 59102010 D	28-07-1994
			DE 59102180 D	18-08-1994
			DE 59102181 D	18-08-1994
			DE 59102183 D	18-08-1994
			DE 59102255 D	25-08-1994
			EP 0490359 A	17-06-1992
			EP 0490360 A	17-06-1992
			EP 0490361 A	17-06-1992
			EP 0490362 A	17-06-1992
			JP 2726176 B	11-03-1998
			JP 7314529 A	05-12-1995
			JP 2726186 B	11-03-1998
			JP 4276423 A	01-10-1992
			JP 4276421 A	01-10-1992
			JP 2726187 B	11-03-1998
			JP 4276422 A	01-10-1992
			JP 5124085 A	21-05-1993
			JP 6039901 A	15-02-1994
			RU 2053121 C	27-01-1996
			RU 2008223 C	28-02-1994
			RU 2002627 C	15-11-1993
			RU 2053122 C	27-01-1996
			RU 2002626 C	15-11-1993
			US 5145352 A	08-09-1992
			US 5141426 A	25-08-1992
			US 5127741 A	07-07-1992
			US 5147198 A	15-09-1992
			US 5221504 A	22-06-1993
			US 5244373 A	14-09-1993
WO 8501467	A	11-04-1985	EP 0155964 A	02-10-1985
			IT 1180231 B	23-09-1987
JP 57075838	A	12-05-1982	NONE	
US 5439633	A	08-08-1995	NONE	
GB 1242481	A	11-08-1971	CA 919165 A	16-01-1973
			DE 1943868 A	09-04-1970
			US 3565403 A	23-02-1971

Patent Abstracts of Japan

PUBLICATION NUMBER : 57075838
PUBLICATION DATE : 12-05-82

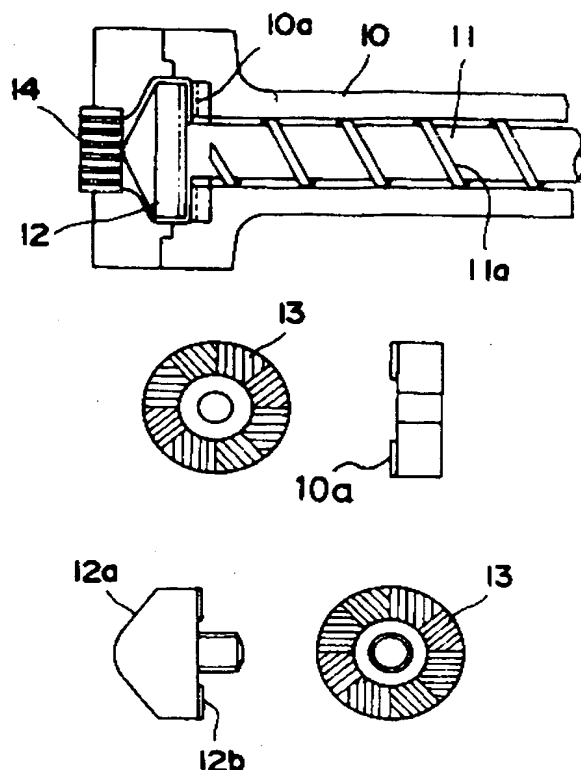
APPLICATION DATE : 31-10-80
APPLICATION NUMBER : 55152197

APPLICANT : MODERN MACH KK;

INVENTOR : EMA EIJI;

INT.CL. : B29F 3/02

TITLE : EXTRUDER FOR KNEADING
THERMOPLASTIC RESIN



ABSTRACT : **PURPOSE:** To provide a thermoplastic resin kneading extruder which has large extrusion capacity and small back pressure with preferable resin kneading and dispersion performance by providing to a shaft at the extrusion end of the extruder a specific gap part expanding radially.

CONSTITUTION: In a resin extruder in which a rotary screw 11 (reference numeral 11a represents fins) is inserted into a cylinder 10, a disc 12 is provided at the end of the screw 11 to form a gap radially expanding between the disc and the cylinder 10, and a number of kneading grooves 13 are formed on the end face 12a of the disc 12 and the inner peripheral end 10a of the cylinder 10 facing to each other.

COPYRIGHT: (C) JPO